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Infographic techniques for the representation of marginal buildings of Salerno coast

Davide Barbato, Sara Morena***

By means of this article, it proposes a cognitive study of the coastal defence system of Amalfi; place rich in history, which is well suited as a case study to experiment the innovative digital techniques for the representation and preservation of cultural heritage.
The interpretation of the building, its forms and its nature has been developed through the integration of monoscopic photogrammetry with BIM, this in order to reach the realization of an infographic image summary with the high knowledge content, and for the enhancement and conservation of these architectures.

Keywords: digital conservation, photogrammetry, building information modelling, towers, LOD.

Brief historical background

Object of interest to historian designer and favourite destination for the *Grand Tour* in the nineteenth century, the coast of Salerno looks like a fascinating territory, unfortunately still not fully "explored". The coastal defence system, in fact, represents just one of different themes on which to start a deep knowledge through the Design discipline

The studies conduct, until now, identify the origins of the first towers during the Roman Empire as a result of the need to monitor its coasts from enemy ready to plunder and steal the cities. The situation is further aggravated after the fall of the Empire, following the breakdown of the Mediterranean between the Christian West and Islamic East; the privateering is radicalized and became a real plundering of the Islamic world on the Salerno coast.

Therefore, the increasing gravity of the situation necessitated the construction of towers scattered throughout the territory to observe and defend the cities from corsair attacks. One of the first interventions dates back to Charles of Anjou (Charles V), around the end of the thirteenth century. It was erected an array of towers which was further increased by the subsequent Aragon dynasty; who built new or adapted the existing to innovative technical defence (the introduction of firearms).

An additional consolidation of the fortifications took place around the sixteenth century by the Spanish viceroyalty; in 1532 with don Pedro de Toledo and in 1563 under the dynasty of don Parafan de Ribera. The difficulty that mostly occurs in this research, is born by the big variety of orographic coastal territory and, therefore, by the large variety of existing towers because it is impossible to predict a single type of construction result from the territorial features in addition to the type of defence to ensure and armament to support. Even today, the Salerno province retains a sufficient number of these testimonies, so, the study, interpretation and analysis through the Design of such artefacts is a valid and useful discipline to trace the history and technique of the individual towers.

Fenosa Tower

The current municipality of Camerota coincides with what in the sixteenth century corresponded to the territory of the University of Camerota, Licusati and Lenticosa and appears as one of the municipalities of the Salerno province with greater extension (fig. 1). At that time, this stretch of coast was largely inhabited and needed an intensification of the defence system due to continuous enemy attacks. In July 1552, in fact, corsairs sacked it violently and much of the population was taken prisoner or died during the assault. In 1563, then, following the pragmatic by viceroy de Ribera, the entire coast from Agropoli to Calabria was involved in an intervention of rehabilitation as well as construction of new towers.

At the beginning of the seventeenth century the planned defence system, in municipality of Camerota, was completed and included towers not only along the coast but also located within the territory to ensure an appropriate visual connection and adequate signalling between these centres and coastal towers. In particular, the following article will proceed to analyse the Tower of Fenosa, a work documented around 1568 by Felice Buongiorno from Cava.

Situated in the locality Fenosa, on a high rocky spur, it was and even today is connected with the remaining towers through the ancient Cavallara road. For centuries, it has been called *Finosa* tower or *Capo delle Gatte* and allows a clear view up to the coast of *Capo Palinuro* on one side and the coves of Marina di Camerota on the other. Therefore, the use of the Design represented the starting point for the analysis and interpretation of the artefact, indispensable condition for the realization of adequate technical and infographic drawings to high information and knowledge content.

The pyramidal trunk construction and very thick walls in limestone suggests that the tower of Fenosa belonged to the type of tower defence. Despite being in ruins, internally it preserves its original division into two large overlapping spaces. The ground floor, with a square base, is covered by a barrel vault, with orientation of sea-mountain, and was formerly used as a cistern for collecting rainwater, channelled through a hole in the wall and that it extends along the entire height of the build.

The upper level, also in this case, is covered by a barrel vault, but with orientation perpendicular to the lower floor (then with a coast-coast alignment); also it presents a series of arched recesses of various sizes and an opening on the sea to enable a wide view and able to supervise any enemy attacks. The last level, the terrace, is accessible by a staircase built into the wall itself, and presents a parapet, which is the crowning of the tower; these volumes, slightly jutting, are interrupted by embrasure that were used for the placement of weapons.

On December 30, 1866 Fenosa tower was included in the decree of King Vittorio Emanuele II in which listed all the towers that ceased to perform the function as a fortress and, so, could be subject to the sale.

1/ Map dating to 1714 of the Province of Citra principality. (Marciana National Library, Venice).

Monoscopic photogrammetry

Based on a photogrammetric survey, it was possible to process the data; the realization of infographic model and rectification of three images for the return of photoplane of the main prospects of the tower. The software implemented is Perspective Rectifier. Using the "Points Rectification" mode, which provides the identification of points with known coordinates (x, y, z). Differently, for the South-West facade, it was impossible to do a direct survey of the same because it is located near a precipice; for that reason, it was decided to proceed to do a hypothetical reconstruction based on the metrics information extracted from the drawings already completed.

The rectified and scaled images were inserted into the CAD where they were used as a basis for the extraction of the necessary measures at the three-dimensional model generation.

The Building information Modelling for the existing building heritage

Beyond the interpretation of the external structures, the study and the survey of the existing building heritage require a greater interpretative and communicative effort other than theoretical: if the classical projects permit an interpretation of the structures and the textures of the tower studied, they are lacking from the perspective of the

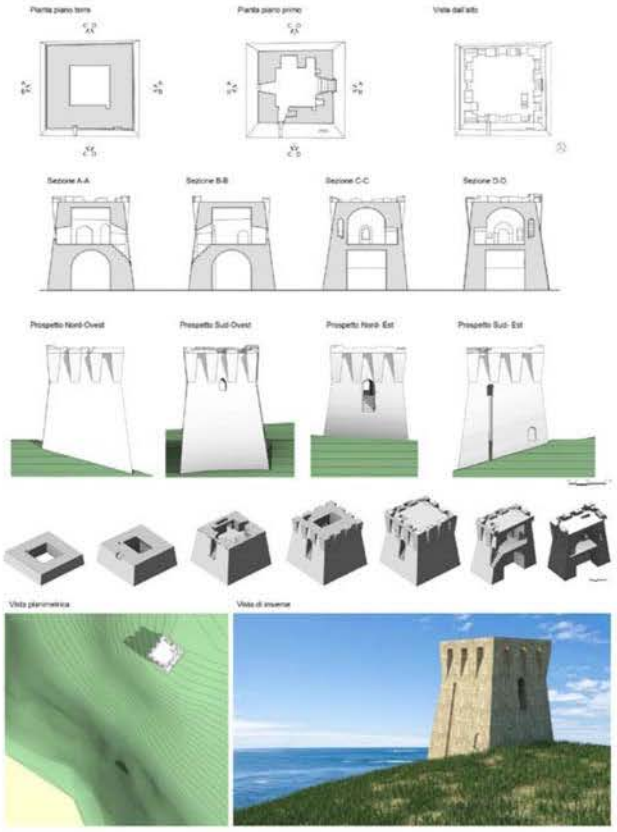
2/ The rectified images of the South-East, North-East and North-West prospects of the tower.

preservation of the geometrical other than alphanumeric information. The maintenance of the data, at the basis of any other process of intervention or enhancement, becomes an essential prerequisite that is able to promote management and enhancement policies of the cultural building heritage.
The Building Information Modelling (BIM) is the optimal instrument for the architectural modeling – and therefore of the forms of the event studied – but also for the accumulation of the data, at the base of the existing heritage enhancement process.
Indeed a BIM model properly implemented, in addition to define the structures in the three dimensions, realizes a communication model, a communicative standard, that can be read and reinterpreted by all the experts, like the strength of the Design which is first of all a "communication language" and, therefore, a source of information.
Of course the three-dimensional return of an architecture as complex as Fenosa Tower requires the adoption of stratagems that allow to solve the difficulties encountered during the modeling of these elements. Indeed, there is a real difficulty when you move from a simple representation of 2D lines to a development of the third dimension in an accurate and meticulous way, even more when you examine the existing building heritage made of unconventional forms that you can hardly parameterize. These difficulties depend also from the Level of Detail and Development (LOD) we want to reach: the higher is the level required, the greater will be the level of difficulty to overcome.
Leaving out the definition of the Acronym LOD that assumes different sense and meaning depending on English or American interpretation, in general it can be stated that the LOD specifications let you specify and articulate with a high level of clarity of the content the reliability of the BIM model, during the different stages of the implementation of the design process, or the reliability of the graphical and informative content put in place for that specific model. It is, once again, a communication language through which users can define the requirements for their own studies or projects. This division into levels of detail – gradually increasing – allows to define as the models are reliable and which usability and limitations they present.
Another problem is linked to the lack of clear definitions concerning the determination of LOD in the case of existing architectures that abound in our country.

The modelling of Fenosa Tower

Two different levels of definition were adopted for Fenosa Tower. The first one it is able to "communicate" just the tower structure in the three dimensions, the second, instead, is more detailed in both the geometries and the contents. For the first model no descriptive information is associated with it that is nothing but an "empty box". A container thus devoid of any content, it is itself that represents the whole; its achievement is of simple execution being the result of elementary operations between surfaces and volumes. The accuracy of the model is such that it provides a rough idea of the work studied and nothing else. The second model, more detailed, represents a conceptual evolution of the previous one: the box initially empty and with generic forms is gradually modelling and conforming itself to the actual state of the Tower (fig. 3). Is highlighted, more accurately, the structure of the Tower attacked by time and historical events that characterized it, it is crumbled in several places and in ruins. It perfectly showed the space covered on the ground floor by the barrel vault and the hole placed on the North-East side of the same made for conveying of rainwater. Upstairs, in the transverse direction compared with the one below, there is the other barrel vault and the stairwell – carved into the wall – that allow the access to the terrace and its breath-

3/ Infographic reproduction of Fenosa Tower



taking view. As well as geometrical, however, for the enhancement of the structure, the level of the supposed detail requires the enrichment of the "box" with additional data, increasing the database also with non-graphical information: construction period, type, classification, land registry data, location, properties and materials are part of the information implemented in this phase.

The tower has been directly inserted into its geographical context of belonging, as well as to obtain additional information regarding the orientation, to the sunlight during the different periods of the year and the effects they have on the territorial context.

Conclusions

Analyse, enhance and propagate the historical and artistic heritage of our cities is a necessary act for the spread of our culture and our history. The design is the perfect discipline for the preservation and dissemination of our works, that is not only necessary to understand the proportions, measurements, volume and comparisons but also to preserve and disclose heritages often not widely known. The new technologies and the new three-dimensional representations even if are not able to replace the classic graphic works, are very close to a real vision and they are as similar as possible to the human one, simplifying the comprehension of the product for an increasing number of users even the nontechnical ones. The database proposed in this paper although significant is still far from covering the needs that lie behind each type of historical work. Nevertheless, the detailed modelling of the Tower and the data implemented in the digital database represent a powerful instrument of protection and, above all of knowledge of the investigated work.

In this perspective, the BIM owns all the characteristics appropriate to represent the instrument of protection and conservation of the existing architectures: the system makes possible not to lose, but rather to save and record the information precisely ensuring a real continuity among the planning stages and during the entire life cycle of the building. The final result we achieved is nothing but the digital and infographic concretization of the structure studied, provided with a high cognitive content, which is a necessary means for the enhancement and preservation of these buildings.

Notes

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